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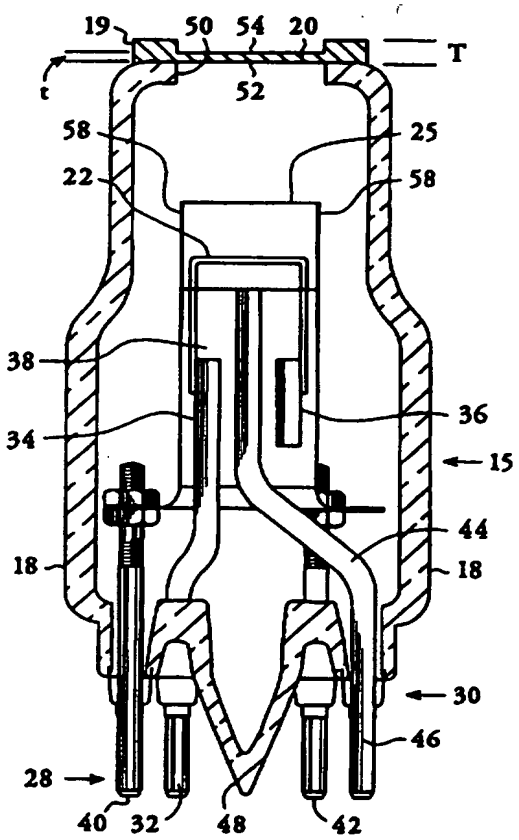
(54) Title: ELECTRON BEAM DEVICE WITH SINGLE CRYSTAL WINDOW AND MATCHING ANODE

(57) Abstract

A vacuum tube electron beam device (15) includes a thin single crystal, electron permeable, gas impermeable membrane (20) for electron transmission. The single crystal membrane may include a small thickness due to high strength, and is highly transmissive to free the electrons due to the small thickness. The ordered crystalline structure of such membrane provides minimal obstructions to electron beams, and yet is highly impermeable to penetration by gas and liquid molecules. A doped silicon anode (19) can provide support for the membrane with matching thermal expansion characteristics, and a crystalline anode can be integral with the membrane. A double membrane embodiment confines the cooling fluid so that it passes close to both membranes.



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AMENDED CLAIMS

[received by the International Bureau on 15 July 1996 (15.07.96); original claims 1 and 6 amended; remaining claims unchanged (2 pages)]

1. An electron beam device comprising,

a body formed from gas impermeable material and defining a chamber having an aperture disposed at one end,

a crystalline substrate positioned on said body to cover said aperture, said crystalline substrate attached to said body forming a fluid-tight seal therewith, with said body forming a generally vacuous chamber, said crystalline substrate including a thin, electron permeable, gas impermeable, single crystal membrane, disposed adjacent to said aperture, said membrane having first and second opposed major surfaces,

means, distally positioned with respect to said membrane, for generating electrons within said chamber,

means, in electrical communication with said generating means, for accelerating said electrons toward said membrane.

2. The device of claim 1 wherein said means for accelerating said electrons toward said membrane includes a crystalline anode connected to said membrane.

3. The device of claim 1 further comprising a crystalline layer affixed to said body pierced by an aperture traversed by at least one supporting structure adjoining said second major surface.

4. The device of claim 1 further comprising,

a solid layer affixed to said body and defining an aperture adjacent said second major surface, said solid layer having a plurality of microchannels in fluid communication with said aperture.

5. The device of claim 4 further comprising a fluid flowing in said microchannels and past said second major surface.

6. The device of claim 1 wherein at least one of said major surfaces includes a plurality of recessed areas defining at least one ridge separating said plurality of recessed areas.

7. The device of claim 1 wherein said membrane is compressed along at least one of said first and second major surfaces.

8. The device of claim 2 further comprising means, connected to said anode, for monitoring a current of said electrons striking said anode.

9. The device of claim 1 further comprising,

a second electron permeable, gas impermeable, single crystal membrane spaced proximate to said second major surface, and

a heat exchanging fluid disposed between said membranes.

10. The device of claim 9 wherein said fluid has a pressure that is greater than a pressure within said chamber and less than an ambient pressure outside said body, whereby said fluid reduces a differential pressure on said membranes compared to that between said chamber and said ambient pressure.

STATEMENT UNDER ARTICLE 19

In response to the International Search Report, claim 1 was rewritten to point out that the electron beam device includes an electron permeable, gas impermeable, membrane formed from a single crystal. Having an electron permeable, gas impermeable, membrane formed from a single crystal distinguishes the claimed invention from the prior art cited in the International Search Report.

Applicant's electron beam device has a single crystal electron permeable, gas impermeable membrane disposed adjacent to an aperture of a body formed from gas impermeable material, forming a generally vacuous chamber with a means for generating electrons being disposed in the chamber. The advantages of employing an electron permeable, gas impermeable, membrane formed from a single crystal is that it increases the probability of electrons exiting the electron beam device. Specifically, a single crystal includes a periodic lattice structure which defines a plurality of unobstructed pathways through which electrons can travel. By forming an electron permeable, gas impermeable, membrane from a single crystal, Applicant has orientated the nuclei of the atoms that form the membrane so as to create a series of pathways that are substantially free of atomic obstacles, thereby increasing the probability that electrons can penetrate the same.

The prior art, on the other hand, does not recognize the problems encountered by Applicant nor the advantages of using single crystal technology in electron permeable, gas impermeable, membranes. To that end, the prior art employs electron permeable, gas impermeable, membranes formed from polycrystalline materials.